PINE BROOK BRIDGE
(Wilder Bridge)
National Covered Bridges Recording Project
Spanning Pine Brook on Town Highway 3
Waitsfield
Washington County
Vermont

HAER VT-37
VT-37

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
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HISTORIC AMERICAN ENGINEERING RECORD

PINE BROOK BRIDGE
(Wilder Bridge)

HAER No. VT-37

LOCATION:	Spanning Pine Brook on Town Highway 3, Waitsfield, Washington County, Vermont UTM: 18.676413.4897082, Waitsfield, VT Quad.
DATE OF CONSTRUCTION:	1872
BUILDER:	Unknown; repaired by Milton S. Graton in 1976-77
PRESENT OWNER:	Town of Waitsfield, Vermont
PRESENT USE:	Vehicular bridge
SIGNIFICANCE:	One of only four kingposts left in Vermont, this example of a once common type underwent an important repair by Milton S. Graton. It also illustrates the public policy issues surrounding historic bridge preservation.
HISTORIAN:	Dr. Mark M. Brown, August 2003, with appendix by Dr. Philip S.C. Caston
PROJECT INFORMATION:	The National Covered Bridges Recording Project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Historic American Buildings Survey/Historic American Engineering Record, a division of the National Park Service, U.S. Department of the Interior. The Federal Highway Administration funded the project.

Description

Pine Brook Bridge is a two-panel kingpost truss covered bridge. Concrete abutments have been inserted on top of older dry-masonry walls. The kingpost braces are 7-1/2" x 9-3/4" and the kingposts are 11" x 11-1/2". Distinctive features of the kingposts are the two tenons at their bottom ends. These tenons are framed into the bottom chords as if they were shear blocks.[1] Rectangular wedges and metal bolts keep the tenons securely attached to the chords. The metal rods in the webbing connecting the kingpost braces with the bottom chord are 1' and 3/4" in diameter, while the compression struts are 2-1/2" x 7-1/2" and 4" x 7-1/2". A 4" x 12" plank rail protects the truss from damage by passing vehicles.

The bottom chords show evidence of extensive alteration and repair. Its oldest looking sections consist of three 5" x 11-1/2" sticks with bolts and shear blocks at the splices. Deck beams, 4-1/2" x 10-1/2" and 8" x 10-1/2" rest on top of the bottom chords and support the 4" thick planks of the 14'-6" wide road surface. About 1/4"- 1/2" below the deck beams are two 36" wide flange steel beams braced by several smaller I-beams. The gap between the steel beams and the deck has been filled with plywood shives and wedges in a manner that takes a substantial portion, if not all, of the live load off of the trusses. There is no lower lateral bracing.

All the significant members above the truss, including the vertical posts that support the rafter beam, the horizontal tie beam and the upper lateral wind bracing system are 6" x 6". The upstream kingpost has a substantial crack, described by some observers as due to spiral grain, which has been stabilized with a U-bolt. [2]

History

Pine Brook is a swift stream that helps drain the eastern side of the Mad River Valley. It represents a lesser obstacle on the east road between the villages of Waitsfield and Moretown. From Moretown, the Mad River descends to the Winooski at Middlesex with Burlington to the northwest and Montpelier to the southeast. Alternately, the upper reaches of the Mad River bring travelers to the White River and from thence to Windsor, Vermont, on the Connecticut River.

General Wait and other founders planning the settlement of the town projected a road on the east bank that would cross Pine Brook as early as 1789.[3] The date of the first bridge across Pine Brook is unknown, but the town officers reported the expenditure of $40.99 for a Pine Brook Bridge at the March 1868 town meeting. Of that, $10.49 went toward 1311' of plank and most of

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[1] According to covered bridge historian Joseph Conwill, "Pine Brook Bridge has a very unusual joint between the kingpost and the lower chord. The post bottom is cut down the middle into two long tenons, which pass between the three members of the chord. Far more usual would be one of the following treatments: A two piece lower chord, with the kingpost passing between the halves, and notched in…; A one-piece lower chord, with the kingpost attached by iron straps…; A one-piece lower chord, but with a metal rod instead of a timber kingpost…."
[2] Ed Barna, *Covered Bridges of Vermont* (Woodstock, Vermont: Countryman Press, 1996), 87-88.
[3] Matt Bushnell Jones, *History of the Town of Waitsfield, Vermont* (Boston: George E. Littlefield, 1909), 31-32.

the balance went for labor. While the current crossing is of modest length, $40.99 does not seem like much for a covered bridge and raises the possibility that it was a stringer bridge.[4] The annual report of March 1873 is much clearer. In the previous year the town spent $301.96 on "Pine Brook Bridge near C. C. Richardson's." Expenses included $124.37 for 63.75 person days of labor, $120.22 for lumber, 1000 shingles at $2.50, 57 pounds of nails at $4.04, and $70.97 for bolts, washers, and freight.[5] In 1905 the town spent $34.60 on planks, stringers, guards, posts, and labor.[6]

The bridge was placed on the National Register of Historic Places on July 1974. This designation was to have an impact on the events leading up to the renovation of the bridge by covered bridge authority Milton S. Graton in the summer and fall of 1976.[7] Even the briefest account illustrates that the interactions of transportation, local politics, and preservation regulations impacting a modest covered bridge is at least as complicated as the renovation work itself. Difficulties and tension were inevitable given the numerous cultures of the parties with interests in the project. Among them were the town officers, the state and federal highway departments, the state and federal preservation programs, Waitsfield residents both in favor and against retaining the bridge, and Graton.

Selected highlights of the controversy include:

> •March 1973. The Waitsfield town meeting voted $10,000 for the repair of the Pine Brook Bridge.[8]
>
> •September 1974. Waitsfield Selectman Edward Eurich learned from Vermont Historic Sites Division staff that federal funds would not be available for a steel beam and concrete deck proposal even though the absence of steel beams would limit loads to 8 tons instead of the desired 10.[9]
>
> •December 1974. At a Special Town Meeting the residents voted 73 to 37 to "RESTORE PINE BROOK BRIDGE BY INSTALLING A WOODEN DECK, USING STEEL BEAMS AT A COST OF $14,000.00 AND THAT THE SELECTMAN MAKE APPLICATION TO THE HISTORIC SITES DIVISION

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[4] *Annual Reports of the Town Officers*, March 3, 1868, in Town Clerk's Office, Town Office, Waitsfield Village, Vermont, hereinafter cited as *Annual Reports*.
[5] *Annual Reports*, March 4, 1873, pp. 4-5. An 1871 map shows a C. Richardson living at the crossroads south of the current bridge. See F. W. Beers, *Atlas of Washington County, Vermont* (New York: F. W. Beers & Co., 1873; reprint, Rutland, Vermont: Charles E. Tuttle Company, 1971), 55 (page references are to the reprint edition).
[6] *Annual Reports*, February 17, 1906, p. 4.
[7] Walter B. Pinney, Director, [Vermont] Historic Sites Division, to Everett Larrow, Chairman, Board of Selectman, Waitsfield, Vermont, July 1, 1974, Pine Brook Bridge folder, Bridges files, Select Board Road Department Files, Town Office, Town of Waitsfield, Vermont, hereinafter cited as Pine Brook Bridge folder.
[8] PETITION FOR SPECIAL TOWN MEETING, October 29, 1974, Exhibit "A," Complaint, Robert Anderson *et al. vs.* Everett Larrow *et al.*, filed July 15, 1975, Pine Brook Bridge folder.
[9] William B. Pinney, Director, Historic Sites Division, Agency of Development and Community Affairs, to Mrs. Fletcher Joslin, Chairman Bicentennial Commission, Waitsfield, Vermont, September 26 1974.

FOR FEDERAL HISTORIC PRESERVATION GRANTS IN AID UP TO THE SUM OF $7000.00 BY DECEMBER 20, 1974." [Uppercase letters in original.][10]

•January 1975. The Vermont Historic Sites Division offered 50/50 matching funds up to $7,000 from a state preservation fund.[11]

•April 1975. Waitsfield selectman completed a $7,000 contract with the state for a project proposal that the state Preservation Division would later claim was for a "new steel bridge not for restoration."[12]

•July 1975. Ten Waitsfield residents received a temporary injunction against the Waitsfield selectmen claiming, among other things, that the selectmen had started the bid process for a proposal fully informed it would not qualify for preservation funds and contrary to the terms of the resolution passed at the Special Town Meeting.[13]

•December 1975. The state highway department sent the selectmen's attorney a set of plans that incorporated recommendations from Milton S. Graton and observed that "the Town of Waitsfield now has three (3) different sets of plans for the repair of the Pine Brook Bridge, (concrete deck, timber deck and restored truss with timber deck)."[14]

•March 1976. The National Park Service approved a grant in aid up to $9,500 "to replace rotten timbers, reinforce the major elements of the truss, install steel beams under the bridge, and stabilize the stone abutments."[15]

•April 1976. Milton S. Graton receives contract in the amount of $14,000.[16]

•September 1976, the state highway department reminds Milton S. Graton that "the anticipated completion date... is now past."[17]

By the end of 1976, the project had cost $9,395 with an additional expenditure of $11,678 in

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[10] "[Minutes of a] SPECIAL TOWN MEETING," December 16 1974, Exhibit No. 3, Summons, Robert Anderson *et al. vs.* Everett Larrow *et al.*, filed July 15, 1975, Pine Brook Bridge folder.
[11] William B. Pinney to Everett Larrow, January 7, 1975, Pine Brook Bridge folder.
[12] Board of Selectmen to William Pinney, April 15, 1975; William B. Pinney to Board of Selectmen, July 3, 1975; both Pine Brook Bridge folder.
[13] Complaint July 15, 1975, p. 3, 5-6; Summons July 15, 1975, p. 31; both Pine Brook Bridge folder.
[14] Milan W. Lawson, District Highway Engineer, District No. 6, Vermont Department of Highways to Adams, Meaker and Darby, Attorneys for Waitsfield Selectmen, December 23, 1975, Pine Brook Bridge folder.
[15] Richard C. Mel[???]g for Jerry L. Rogers, Chief, Division of Grants, National Park Service, to William B. Pinney, March 15, 1976 and attached Standard Form 240 "Notification of Grant-In-Aid Action," Pine Brook Bridge folder.
[16] Waitsfield Selectmen to Milton S. Graton, April 5, 1976, Pine Brook Bridge folder.
[17] J. R. Phalen, Construction Engineer, Vermont Department of Highways, to Milton S. Graton, September 3, 1976, Pine Brook Bridge folder.

1977.[18]

After working on both the Village Bridge in 1973, and the Pine Brook Bridge in Waitsfield, Graton observed:

> we have spent some of our own money there, paid for travel distance of the school bus, avoided payment of a threatened three thousand dollar late fine, saved two nice old covered bridges, left town without being shot at and left the "Hatfields and McCoys" to fight it out.[19]

Graton's Repairs[20]

Unlike state highway department employees, Milton S. Graton did not generate extensive project records.[21] As a result, it is largely through oral history, historic photographs, highway department records, and close scrutiny of the bridge fabric itself that we can begin to determine the nature and extent of Graton's work.

A photograph, taken by Edmund Homer Royce ca. 1940 of the interior of the Pine Brook Bridge, shows a different configuration of the truss webbing than current conditions.[22] Instead of the current two diagonals and two vertical rods, which combined with the kingpost produce a total of six panels, the photograph shows the bridge with four panels. Also visible are vertical compression members adjacent, and parallel, to the tension rods. The changes are further documented by the December 1975 highway department drawings.[23] The drawings show the intent to replace the single connection on each of the kingpost braces with two connections and heavier timbers. Since these alterations are incompatible with the earlier configuration, the

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[18] *Annual Reports*, December 1976, p. 8, and *Annual Reports*, December 31, 1977, p. 9.

[19] Milton S. Graton, *The Last of the Covered Bridge Builders* (Plymouth, New Hampshire: Clifford-Nicol, Inc., 1986), 134. On the Hatfield and McCoy feud see Altina L. Waller, *Feud: Hatfields, McCoys, and Social Change in Appalachia, 1860-1900* (Chapel Hill: University of North Carolina Press, 1988).

[20] Covered bridge historian Joseph Conwill notes that he took photographs of Pine Brook Bridge in 1973, prior to Graton's repairs. These will be published in the Winter 2004 issue of *Covered Bridge Topics*. According to Conwill, the photos include a view of a brace-chord joint, which may have been similar to the unusual kingpost-chord joint mentioned in the description section of this report. "That is, the brace may have been divided into two long tenons, which passed between the three members of the chord. The photos show that there is no dap in the chord to receive the brace ends (unless perhaps it is a closed mortise instead, not visible from camera position) and that the joint appears to be fixed by at least one large bolt, probably at least two. This arrangement would transmit all the thrust into shear forces on the bolts, partly mitigated by friction between the timber elements if the bolts are kept tight. It is a rather poor arrangement, I think."

[21] Arnold Graton Jr., Graton Associates and Grandson of Milton S. Graton, Telephone conversation with author, July 21, 2003.

[22] The photograph was published in Herbert Wheaton Congdon, *The Covered Bridge: An Old American Landmark*, 3rd ed. (Middlebury, Vermont: Vermont Books, 1959), 111.

[23] "Truss Repair" (December 1975) and "Details & Quantities" (April 1975 drawings in *Bridge No. 20, Pine Brook Bridge, carrying Town Highway 03 across Pine Brook*. Report Prepared for the Vermont Historic Bridge Program by McFarland-Johnson, 1995, in Records of the Vermont Agency of Transportation, Project Development Division, Montpelier, Vermont.

highway department and Graton were clearly contemplating removing material. Inspection of the bridge reveals the holes in the kingpost braces and the bottom chords once used by the original vertical rods.

The reasons for these changes seem two fold. The new web arrangement increased the strength of the bottom chord by shortening the panel lengths and correspondingly reducing bending stress generated by the deck beams loads. Indeed, the state highway department drawings show that the new inner four panels of the bridge are 7'-3" as compared to the single 12'-1-3/4" lengths of the two middle panels they replaced. A simple graphic analysis using arbitrarily selected loads shows that while loads in the bottom chord and kingpost brace increase somewhat, the loadings in the less robust web members undergo a respectable drop.[24] By increasing the number of web members, and increasing their cross section Graton increased the capacity of the bridge while using technologies available to the original builders.

Graton also made substantial repairs to the bottom chord. In essence, Graton used a series of splices and replacements at the ends of the bottom chords, areas that not only are prone to rot but are also subject to high stresses.

While the steel beams beneath the deck are currently load bearing, this was not Graton's original intent. Rather, as Graton explains, the steel beams were put under the bridge leaving a half-inch gap between them and the deck as a concession to competing visions for the bridge while keeping true to his own sense of the right way of doing things. Graton could argue that he was "storing" the beams under the bridge for the convenience of the town and point out, quite truthfully, to preservationists that the trusses and not the beams carried the loads.[25] Town and highway officials and were reassured that the steel beams would prevent catastrophic failure. While the current shives and wedges compromise this solution, they are also reversible.

Conclusion

While kingposts are among the simplest trusses, the Pine Brook Bridge shows that they need not have simple histories. As one of only four kingposts left in Vermont, even this simple form is becoming very scarce.[26] Pine Brook is also important as an example of Milton S. Graton's approach to keeping covered bridges as working trusses, and of the public policy issues that

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[24] Descriptions and explanations of the methods used in the analysis can be found in Thomas E. Boothby, "raphic Funicular Analysis Methods and Their Application to Stone and Metal Bridges,"in *Proceedings of and International Conference on Historic Bridges to Celebrate the 150th Anniversary of the Wheeling Suspension Bridge*, ed. Emory Kemp (Morgantown, West Virginia: West Virginia University Press, 1999), 147-155; and numerous nineteenth and early twentieth century text books such as International Correspondence School, *Design of Roof Trusses and Mill Buildings* (Scranton, Pennsylvania: International Textbook Company, 1907).

[25] Graton, *The Last of the Covered Bridge Builders*, 134.

[26] The other Vermont kingposts are: Mosely in Northfield, Scott in Townsend (approach spans) and Kidder in Grafton. In addition, there are also a number of highly modified versions of the kingpost in Vermont. David W. Wright and Joseph Conwill of the National Society for the Preservation of Covered Bridges, Telephone conversations with author, August 6 and 19, 2003.

emerged with preservation legislation in the 1960s and 1970s.

Appendix A, "Recording Pine Brook Bridge," by Dr. Philip S.C. Caston

In August 2002, Eric DeLony, Chief of the Historic American Engineering Record (HAER) invited Dr. Philip S.C. Caston, Neubrandenburg University of Applied Sciences, Germany, to join the second phase of the National Covered Bridges Recording Project under the auspices of the International Committee on Monuments and Sites (ICOMOS). Dr. Caston, Professor of Building Documentation, Historic Building Research and Surveying, had experience with German methods of documenting timber structures, and DeLony was interested in exploring their potential in the United States. The Pine Brook Bridge was selected because of its small size and numerous alterations, which could demonstrate the potential of these methodologies within the time and resources available. The description of Caston's procedures is included in order to comply with Standard II of the *Secretary of the Interior's Standards for Architectural and Engineering Documentation* because they are different from HAER procedures.[27]

While HAER developed the scope of work for the summer of 2003, HAER Chief Eric DeLony invited Dr. Philip S.C. Caston to test out and introduce his methods to HAER. Professor Caston and two young professionals (Dipl.-Ing. (FH) Arnold Kreisel and Dipl.-Ing. Nadine Silvia Bauer) spent a week on site from May 26 to May 31, 2003 measuring the bridge and directly recording the results at a scale of 1:24 on white, acid-free, archival cartridge paper. The recordings were digitized (scanned) at the HAER office in Washington, DC. The resulting black and white pixel representations were then inserted into standard HAER CAD drawings and included as part of the drawing set. The original cartridge paper drawings are included with the field notes, which are available at the Library of Congress, Prints and Photographs Collection.

In addition to the standard set of HAER documentation drawings, Pine Brook Bridge documentation includes longitudinal and cross section drawings that Caston and his team measured and drew on site using graphite pencil on cartridge paper. Pine Brook's relatively small size, wooden construction with numerous surface features and other interesting details made the ideal structure to try out the recording methods used by building archaeologists in Germany.

The concept behind using graphite pencil and cartridge stems from two fundamental beliefs. First, every historical monument is a unique and individual entity requiring a level of observation and accurate measurement necessary to capture these qualities. Second, the recorded data should be as archivaly stable as possible to allow the information to be handed down to successive generations.

Recording historic structures has a long history with numerous developments and changes in graphic representation. Since documentation cannot duplicate the object to 100 percent, drawings can be understood as a filtering of information that can range from a graphically simple

[27] Standard II states "Documentation Shall be Prepared Accurately from Reliable Sources with Limitations Clearly Stated to Permit Independent Verification of the Information" and "the documentation must include information to permit assessment of its reliability." See *Federal Register*, 48, no. 190 (Thursday, September 29, 1983): pp. 44730-31.

schematic representation using a minimum of lines to delineate the object to the more complex collection of extreme detail such as patina and minute deformations. It is not surprising that different groups of building archaeologists and others recording structures place different emphasis on the type and quality of recording and that as a result different cultures of recording and aims have arisen.

German architects, like those in the United States and other European nations, began recording classical and later medieval buildings in the nineteenth century. They achieved the highest level of graphic representation using graphite or lead pencils on cartridge paper. Their aim was not to reduce the drawings to a minimum of useful information, conveying just sizes and shapes, but to try to capture important data to understand the history. This meant recording the surfaces and distinguishing the differences between them as well as analyzing and delineating details (such as differently sized small objects) accurately and recording their exact position. The results are drawings containing a wealth of important data from which the object or building can be analyzed from a historical perspective.

This type of documentation became the standard recording method of those specializing in historical analysis of buildings on site. It developed over the years, culminating in Germany in today's archaeological practices and archaeologists. Some architects retained this quality in their representations of historic buildings and structures. However, with the increased emphasis in German architecture schools on non-historically based influences in design, most architects were no longer confronted with historical materials or methods. This lack of respect for historical buildings and structures by architects in general, coupled with the widespread perception of building preservation as aiming to solely protect, or even to recreate the appearance of, monuments, lead to dramatic changes in the graphic representation of the buildings or objects and a reduction in historic data obtained. This is understandable if the aim is to simply replace materials or objects in a reconstruction. To make a new beam for example, you only need to know its shape, dimensions and material so only that information gets recorded. This kind of measuring and drawing lends itself to "technical" drawing techniques (simple line drawings, photogrammetric analysis, ink delineations), which are still in practice and currently being refined using CAD.

In the post World War II years, German architects working in building preservation mainly employed these "technical" recording techniques, but it soon became apparent that the important historical information was lacking. The method of two or three people measuring the structure and sketching it, returning to the office, drawing, searching for missing measurements and interpolating, returning to the structure to collect the missing measurements, remeasuring, returning to the office again, correcting etc. was found to be inefficient and inexact, resulting in the delineated structure being too abstract and riddled with mistakes to be of any practical use in preservation work.[28]

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[28] This is a direct translation and quote take from G. T. Mader's opening paragraph from: *Bauaufnahme als Forschungsmethode und Bestansdokumentation des Denkmalpflegers* [Building Recording as a Research Methodology and Building Documentation of Preservationists] in: *Bauaufnahme – Bestandsuntersuchung und Dokumentation historische Bauwerke* [Building Recording – Investigation and Documentation of Historic

In the late 1970s and early 1980s, attempts were made in Germany to introduce archaeological drawing methods into the recording of historical buildings above the ground. In addition to the efforts of the Karlsruhe University's "Special Research Division 315," Gerd Thomas Mader of the Bavarian State Conservation Office advocated for the "new-old" methods being taught in German universities again.[29] Changes in the perception of building preservation to include preservation of the original fabric of the structure, its authenticity and a new awareness of the importance of defining a building's or structure's history coupled with the new economic strength of Germany at this time, were the key factors behind the acceptance of this new-old level of documentation.

In order to completely document a building's or structure's history, it was necessary to return to intensive manual recording. Graphite pencils allow the recorder to simply and efficiently delineate using different line weights, shadings etc. with reliable and practical instruments. A datum with parallel levels and perpendicular verticals defines an absolute and perfect reference from which the structure's deformations can be accurately recorded and drawing on acid-free cartridge paper with a proven five century life expectancy is the optimum medium for graphite. Recording at this level means a departure from sketching, measuring and redrawing etc. The recordings are done in their entirety on site to ensure accurate and intensive observations and data recording.

The final cartridge paper drawing is the master for this data storage and contains observations, measurements, sketched surface features and lines marking the physical boundaries of the objects recorded. As such the drawing is a unique mixture of field note and final drawing which leads to the question of its further use. Recent developments in copying and scanning technology mean that the measured drawing can be easily reproduced either in its original form or "cleaned up" for presentation purposes.[30] These drawings have been successfully integrated into the HAER measured drawings set (see Pine Brook Bridge drawings sheets 5-7) as raster copies on HAER Mylar of the original cartridge paper recordings.

Monuments], (Arbeitsheft des Sonderforschungsbereiches 315, Erhalten Historisch Bedeutsamer Bauwerke der Universität Karlsruhe, Karlsruhe 1987), p 45.

[29] In addition to the publication mentioned in the footnote above, a second publication by the SFB 317 *Bauaufnahme – Befunderhebung und Schadensanalyse an historischen Bauwerken* [Building Recording – Inventory and Damage Analysis], (Karlruhre 1988) laid the foundation for current German building recording.

[30] See Fig 22 and text: Schuller, p 32.

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ADDENDUM TO:
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PHOTOGRAPHS

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